

OPERATING INSTRUCTIONS

TYPE 1301-A
LOW-DISTORTION OSCILLATOR

... SINCE 1915
manufacturers of
electronic apparatus
for science and industry



G E N E R A L R A D I O C O M P A N Y

CAMBRIDGE 39, MASSACHUSETTS, USA

**OPERATING AND MAINTENANCE
INSTRUCTIONS**

**TYPE 1301-A
LOW-DISTORTION OSCILLATOR**

Form 651-H
August, 1957

GENERAL RADIO COMPANY
275 MASSACHUSETTS AVENUE
CAMBRIDGE 39 MASSACHUSETTS

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SPECIFICATIONS

FREQUENCY RANGE:	27 fixed frequencies between 20 and 15,000 cps (also 2 to 15 cps with Range Extension Unit).
FREQUENCY CONTROL:	Nine frequency selector buttons and three multiplier buttons.
FREQUENCY STABILITY:	Drift no greater than 0.02% per hour after 10-minute warm-up. Changes in a-c line voltage or output load do not affect frequency.
OUTPUT IMPEDANCE:	Push-button selection of any of three output impedances: 600 ohms balanced to ground, 600 ohms unbalanced, or 5000 ohms unbalanced. Actual output impedance of 5000-ohm circuit varies between 1000 and 6000 ohms, depending on volume control setting, which also affects 600-ohm output circuit slightly. The 600-ohm balanced output circuit is balanced to all audio frequencies when operated into a balanced load of any impedance.
OUTPUT POWER:	18 mw into 600-ohm load, or 6.6 v open circuit; 100 mw into 5000-ohm load, or 30 v open circuit. Output voltage for either impedance position will remain constant within ± 1 db throughout frequency range.
WAVEFORM:	Distortion not more than 0.1% with 5000-ohm output; for 600-ohm output, not more than 0.1% between 50 and 7500 cps, not more than 0.25% below 50 cps. When Range Extension Unit is used, distortion is less than 1% for added range.
TERMINALS:	Jack-top binding posts with standard $\frac{3}{4}$ -in. spacing. Separate ground terminal has strap to ground LOW output terminal. Output is also available at rear of instrument at multipoint connector, for which mating unit is supplied.
MOUNTING:	Relay-rack panel. Type FRI-412 end frames are available for table mounting.
POWER SUPPLY:	105 to 125 (or 210 to 250) v, 25 to 60 cps. Power consumption about 45 watts.
DIMENSIONS:	Panel width 19 in., panel height 7 in., depth behind panel 12 in.
WEIGHT:	31½ lb.

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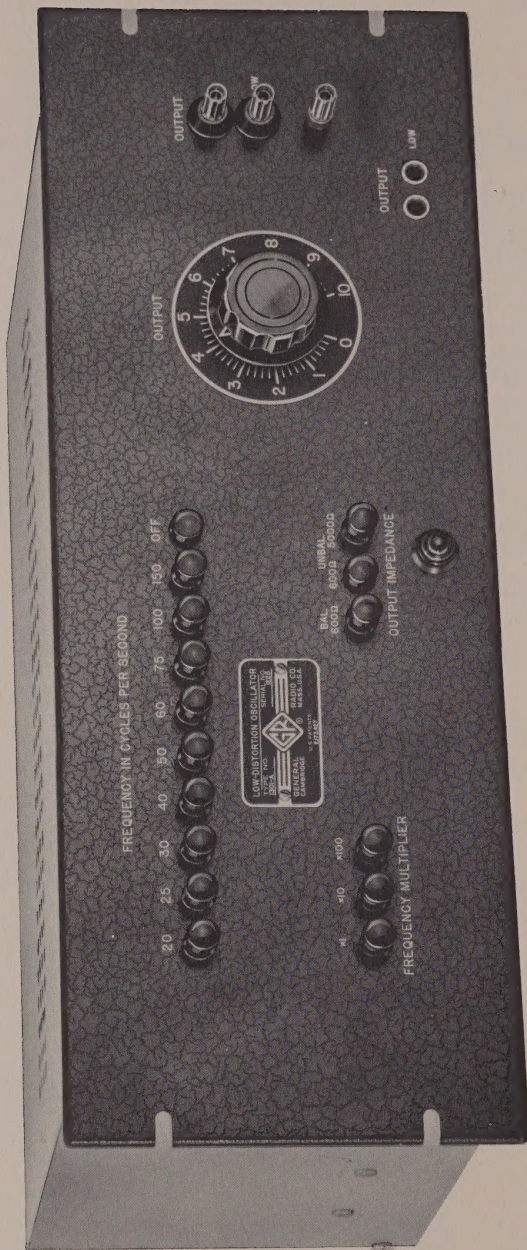


Figure 1. Type 1301-A Low-Distortion Oscillator.

TYPE 1301-A

LOW-DISTORTION OSCILLATOR

Section 1

INTRODUCTION

1.1 PURPOSE. The Type 1301-A Low-Distortion Oscillator (Figure 1) is a source of audio-frequency power of extremely pure waveform, useful in distortion measurements on audio-frequency equipment and as a general-purpose laboratory oscillator.

1.2 DESCRIPTION.

1.2.1 GENERAL. The Type 1301-A Oscillator uses the inverse-feedback r-c circuit invented and developed by General Radio Company. Separate feedback networks control frequency and amplitude independently of each other, providing high stability and low distortion. Amplitude control is automatic, normally requiring no adjustment as various frequencies are selected.

1.2.2 CONTROLS. The following controls are on the panel of the Type 1301-A Low-Distortion Oscillator:

<u>Name</u>	<u>Type</u>	<u>Function</u>
FREQUENCY IN CYCLES PER SECOND	10 push buttons	Nine frequency selectors and an OFF button.
FREQUENCY MULTIPLIER	3 push buttons	Multiplies FREQ IN CPS setting by 1, 10, 100, to provide 27 possible frequencies.

<u>Name</u>	<u>Type</u>	<u>Function</u>
OUTPUT	Continuous rotary control	Controls output power.
OUTPUT IMPEDANCE	3 push buttons	Selects 600-ohm balanced or unbalanced, or 5000-ohm unbalanced output impedance.

1.2.3 CONNECTIONS. Three sets of output connections are provided: jack-top binding posts and Western Electric jacks at the front panel, and a multi-point connector for permanent installation at the rear.

1.2.4 ACCESSORIES. Supplied with the Type 1301-A Low-Distortion Oscillator are a power cord, multipoint connector, Type 1301-201 Plug Assembly, and spare fuses.

The Type 1301-P1 Range Extension Unit, available from General Radio, adds a fourth (0.1) multiplier, extending the frequency range down to 2 cycles per second.

Section 2

OPERATING PROCEDURE

2.1 INSTALLATION.

2.1.1 POWER SUPPLY. The oscillator may be operated from any 115- or 230-volt, 25-60-cycle source. Instruments are normally shipped wired for 115-volt

operation, but may easily be reconnected for 230-volt use by reference to the power-transformer terminal wiring as shown in Figure 9. When converting the instrument from one input voltage connection to the

other, be sure to reverse the power-supply nameplate and to replace the fuses with those of proper rating (refer to Parts List).

2.1.2 OUTPUT CONNECTION. Permanent output connection may be made at the multipoint connector at the rear of the jack. Jack-top binding posts with standard $\frac{1}{4}$ -inch spacing are available at the front panel, as well as Western Electric jacks. A plug inserted in the Western Electric jacks automatically disconnects the other output connections.

2.1.3 DUMMY PLUG. Unless the Type 1301-P1 Range Extension Unit is being used with the oscillator, the Type 1301-201 Plug supplied with the oscillator must be plugged into the six-terminal socket SO1, to avoid damage to the 6Y6-G tube (V6).

2.1.4 RANGE EXTENSION UNIT. The Type 1301-P1 Range Extension Unit, which extends the frequency range of the oscillator down to 2 cps, is easily fastened inside the oscillator by means of locating pins (see Figure 7). Two connecting cables with multipoint connectors are brought to matching sockets in the oscillator. The dummy plug (paragraph 2.1.3) should be removed and the six-terminal cable plug inserted in SO1.

2.2 OPERATION.

2.2.1 PRELIMINARY. To turn the instrument on, push any one of the FREQUENCY IN CYCLES PER SECOND buttons. Before turning on the oscillator, make sure that the supply voltage and frequency agree with those indicated on the power-supply nameplate.

After a minute or two, the small neon lamp below the OUTPUT IMPEDANCE buttons should show a steady, brilliant, red glow. If the lamp flashes steadily at intervals of about 20 seconds, it is defective and should be replaced.

If the MULTIPLIER setting is changed from one extreme to the other, the lamp may fail momentarily. This does not mean the lamp is defective, but merely indicates a sudden change in the applied d-c potential across the AVC circuit.

2.2.2 FREQUENCY SELECTION.

2.2.2.1 General. Select the operating frequency by pushing the appropriate FREQUENCY IN CYCLES PER SECOND and FREQUENCY MULTIPLIER buttons. For instance, for a frequency of 7.5 kc, push the 75 and $\times 100$ buttons.

2.2.2.2 Transients. The oscillator may require a few seconds to attain a stable oscillation whenever the frequency is changed by means of the push buttons. The effect is negligible except on the lowest frequency range, and is due to the necessarily longer time constants of the AVC circuit. To accelerate the oscil-

lation rate of amplitude increase, a set of contacts for each FREQUENCY IN CYCLES PER SECOND button momentarily removes the AVC bias voltage, thus permitting oscillations to start quickly.

2.2.2.3 Operation With Range Extension Unit. To operate the Type 1301-P1 Range Extension Unit, which provides an additional multiplier range of 0.1, first release all three MULTIPLIER buttons. To do this, push any one of these buttons partly in, so that it releases any latched buttons, and then let it snap back out. Then, with all MULTIPLIER buttons released, the frequency will be the product of the FREQUENCY IN CYCLES PER SECOND switch and 0.1.

When the oscillator is operated at the lowest frequency in this range (2 cps), a period of about 10 seconds will be required to reach a stable oscillation amplitude. For other frequencies the time will decrease, and will be inversely proportional to the operating frequency. The stable oscillation point will be controlled by the AVC to within one db, eliminating the need for most adjustments.

2.2.2.4 Other Frequencies. Just behind the panel of the instrument, near the top, are three Type 274 jacks, labeled A, B, and C. By connecting a set of three calibrated resistors to these terminals, you can adapt the oscillator to operate at any specific frequency from 20 to 15,000 cps. The values of these resistors for any frequency may be approximated from Figure 2. Determine the exact value by scaling from any known

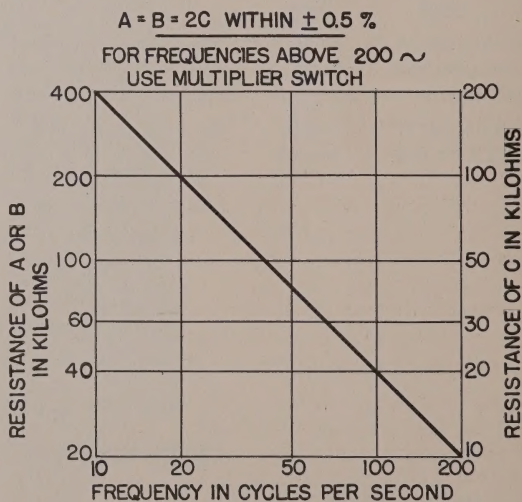


Figure 2.
Values of Resistors A, B, and C for Frequencies Between 20 and 15,000 Cycles Per Second.

resistance value used in the instrument, at a frequency near the desired one. R varies inversely with frequency.

2.2.3 OUTPUT IMPEDANCE. The output impedance may be either 600 ohms balanced or unbalanced, or 5000 ohms unbalanced, depending on the OUTPUT IMPEDANCE button pushed. The 600-ohm position uses transformer coupling and can thus be operated into either a balanced or grounded line, whereas the 5000-ohm position can be operated unbalanced only. The OUTPUT control varies the output level for all three positions semilogarithmically. Since this control is a potentiometer, the output impedance is not constant for the 5000-ohm output. The 600-ohm output is essentially constant due to a resistive isolation network. A curve of the effective output impedance vs potentiometer setting is given in Figure 3.

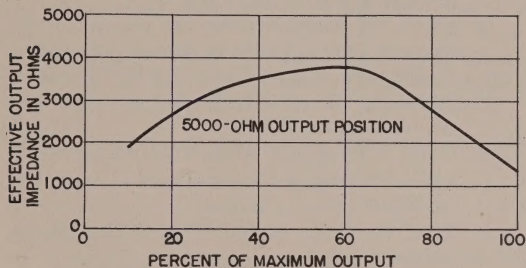


Figure 3. Effective Output Impedance vs Output Control Setting.

Use of the 600-ohm output is not recommended during operation on the extreme low-frequency range of the Range Extension Unit, because of the high distortion introduced by the output transformer. The 5000-ohm output has a harmonic content of about one percent when used with the Range Extension Unit.

2.3 OUTPUT POWER. The output power is about 18 milliwatts into a 600-ohm load, or about 100 milliwatts into a 5000-ohm load. Open-circuit output voltage is at least 30 volts. The output voltage for either impedance will remain constant within 1 db of its 400-cycle value throughout the frequency range.

2.4 OUTPUT WAVEFORM.

2.4.1 5000-OHM OUTPUT. The total harmonic distortion will not exceed 0.1 percent between 40 and 7500 cycles. At other frequencies the distortion may increase to 0.15 percent. The over-all distortion is quite free from variation due to load impedance changes between 5000 ohms and open circuit. For load impedances below 5000 ohms, the distortion will increase slightly, as shown in Figure 4.

2.4.2 600-OHM OUTPUT. The total harmonic distortion will not be greater than 0.1 percent between 40 and 7500 cycles with a 600-ohm load. Below 40 cycles, the distortion may increase to 0.25 percent. Due to the use of an output coupling transformer, the distortion at the extreme low frequency increases. Above 7500 cycles the distortion will not exceed 0.15 percent.

2.5 EFFECTS OF LINE-VOLTAGE CHANGE. Internal voltage regulation permits operation over a range of 105 to 125 (or 210 to 250) line volts. Line-voltage transients have no effect on the operating characteristics of the instrument. A line-voltage variation of 10 volts from the 115-volt value will cause no more than 0.03 percent change in oscillator frequency. This effect occurs only when the line voltage is shifted and held constant at the new value. A line-voltage transient of the same order of magnitude will cause no observable shift in the oscillator frequency.

2.6 HUM LEVEL. The output hum level will not exceed 0.05 percent of the output voltage.

2.7 EFFECTS OF TUBE CHARACTERISTICS. The oscillator has been carefully designed to minimize the effects of tube characteristics. The 6SJ7 and 6Y6-G tubes are the only ones that might affect harmonic content. Most tubes will operate satisfactorily, but occasionally a combination of these two tubes will be found that causes the harmonic content to increase very slightly. The output voltage will remain constant within 10 percent for all types of tubes.

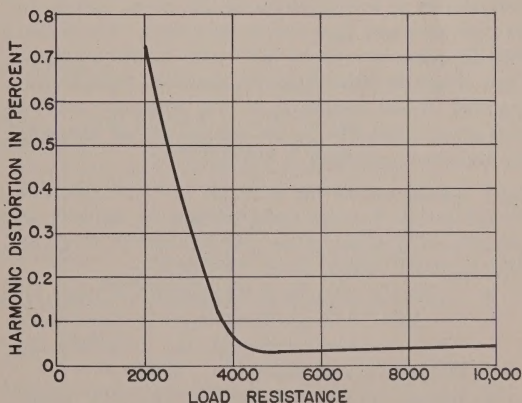


Figure 4.
Distortion vs Load Resistance
for the 5000-ohm Output Position.

Section 3

SERVICE AND MAINTENANCE

3.1 GENERAL. The following information, together with that given in preceding sections, should enable the user to locate and correct ordinary difficulties resulting from normal use. Major service problems should be referred to our Service Department, which will cooperate as much as possible by furnishing instructions as well as by supplying any replacement parts needed. When writing to our Service Department, please specify the serial and type numbers of the instrument, and give a detailed report of trouble encountered, as well as steps taken to remedy the trouble.

Before returning an instrument for repair, please write to our Service Department, requesting a Returned Material Tag, which includes shipping instructions. Use of this tag will facilitate handling and identification of the instrument returned. A purchase order covering repair of material returned should also be forwarded to avoid unnecessary delay.

3.2 TROUBLE-SHOOTING DATA.

3.2.1 GENERAL. For the location of those components that require readjustment, see the interior views, Figures 7 and 8.

3.2.2 INSTRUMENT INOPERATIVE; PILOT LIGHT DOES NOT LIGHT. If the pilot light does not come on after one of the FREQUENCY buttons is pushed and the warm-up period has passed, check the power line for proper voltage and frequency, the power cord for open circuit or poor contacts in the outlet, and fuses for continuity and tightness in fuse clips. Check that tube filaments are lit or that metal tubes are warm. Then check the neon light P1, the OFF switch, connections to and continuity of T2, continuity of R41 (and check that R41 is not shorted to its mounting bracket), and continuity of R42 and R43.

3.2.3 PILOT LIGHT ON BUT NO OUTPUT ON ANY FREQUENCY. If, with the pilot light on, there is no output on any position of the FREQUENCY IN CYCLES PER SECOND switch, check the following:

- a. Check pin voltages of V5 through V9 (Table 1).
- b. Check R32, R33, and R34 for open or short circuit.
- c. Check continuity through the OUTPUT IMPEDANCE switch S2B.
- d. Check resistances across OUTPUT terminals (Table 2).
- e. Remove B1 and use an ohmmeter to check for shorts between rotor and stator of C102, C103, and C107.

CAUTION

Do not disturb the settings of C102, C103, and C107. These factory-set adjustments control frequency and output level on the high range.

- f. Measure the resistance from the stator of C102 to the stator of C103; it should be 53,333 ohms $\pm 0.1\%$ with the 150 FREQUENCY button in. This checks the continuity of part of S1 and the resistance of R109 and R129.
- g. Check the resistance from the junction of the rotors of C102 and C103 to ground; it should be 13,000 ohms $\pm 0.1\%$ with the 150 FREQUENCY button in. This checks another part of S1 and the resistance of R119.
- h. Check R101 through R108, R111 through R118, and R121 through R128 for open or short circuits and for proper values.
- i. Check the action of the AVC amplifier, V8, as follows:
 - (1) Check pin voltages against those in Table 1.
 - (2) Remove V8. The output voltage should increase substantially.
 - (3) Check for a defective resistor or capacitor in the circuit.
- j. Check the amplifier circuit, V5 and V6, as follows:
 - (1) Check pin voltages against those in Table 1.
 - (2) Remove V7 and apply 1.0 v, 1000 cps through a blocking condenser to pin 4 of V5. Set panel buttons for 1000 cps and 5000 ohms unbalanced. The voltage at the OUTPUT terminals should be 20 to 30 volts, measured with a vacuum-tube voltmeter.
 - (3) Check for a defective resistor or capacitor in the circuit.
- k. Check the regeneration control circuit as follows:
 - (1) Check pin voltages against those in Table 1.
 - (2) Disconnect C9 from R30. Set panel buttons for 1000 cps and 5000 ohms unbalanced. Apply 10.0 v, 1000 cps to the disconnected end of C9. Note that an increase of signal voltage will increase the output voltage to about 30 v, after which the output should stay substantially constant for any further increase of signal voltage.

TYPE 1301-A LOW-DISTORTION OSCILLATOR

TABLE 1
TUBE TEST VOLTAGES

TUBE	PIN	VOLTS TO GROUND	TUBE	PIN	VOLTS TO GROUND	TUBE	PIN	VOLTS TO GROUND
V1 (6X5-GT/G) RECTIFIER	2-7	6.3 ac	V4 (OD3) REGULATOR	2	2.3	V7 (6SK7) REGENERATION CONTROL	2-7	6.3 ac
	3	340 ac		3	280		3	60 *
	5	340 ac		5	150		4	40 *
	7	280		6	280		5	60 *
	8	410		7	28.0		6	85 *
				8	3.0		8	85 *
V2 (6B4-G) REGULATOR	2-7	6.3 ac	V5 (6SJ7) OSCILLATOR- AMPLIFIER	2-7	6.3 ac	V8 (6SQ7) AVC AMPLIFIER	2	30 *
	3	410		4	-0.5		3	60 *
	5	250		6	30 *		4	50 *
	6	280		8	100		5	45 *
	7	280					6	225
							7-8	6.3 ac
V3 (6SL7-GT) CONTROL TUBE	1	150	V6 (6Y6-G) OSCILLATOR- AMPLIFIER	2-7	6.3 ac	V9 (GE NE-17) REGULATOR		60 *
	2	255		3	280			(should glow steadily)
	3	150		4	280			
	5	150		5	100			
	6	3.0		6	280			
	7-8	6.3 ac		8	125			
	8	3.15						

NOTES:

* Measured on 250-v range of Weston 772 Analyzer.

Use 20,000-ohm/volt meter for all voltages.

All voltages dc except as otherwise noted.

All voltages are $\pm 20\%$.

FREQUENCY switches set to 1000 cps.

600-ohm BAL OUTPUT, with 600-ohm load
in place.

OUTPUT control at maximum.

TABLE 2
TEST RESISTANCES

OUTPUT Setting	OUTPUT IMPEDANCE Setting	J1 to Ground	J2 to Ground	High binding post to ground	LOW binding post to ground
Maximum	BAL 600	∞	∞	∞	∞
Maximum	UNBAL 600	500 Ω	0	500 Ω	0
Maximum	UNBAL 5000	10,000 Ω	0	10,000 Ω	0
Minimum	BAL 600	∞	∞	∞	∞
Minimum	UNBAL 600	500 Ω	0	500 Ω	0
Minimum	UNBAL 5000	1000 Ω	0	1000 Ω	0

NOTE: Remove Range Extension Unit, and be sure plug PL2
is in place in socket SO1.

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- (3) Check for a defective resistor or capacitor in the circuit.

1. Check the power supply as follows:

- (1) Check pin voltages at V1, V2, and V3 against those in Table 1.
- (2) Check V4 and operating voltage. This tube should glow steadily.
- (3) The voltage between pin 6 of V4 and ground should be 280 v dc; if it isn't, set it to 280 v dc by adjusting R9.
- (4) Check continuity of T2.
- (5) Check for a defective resistor or capacitor in the circuit.

3.2.4 OSCILLATOR INOPERATIVE ON RANGE EXTENSION ONLY. If the oscillator operates satisfactorily on its own ranges but does not function on the low range of the Range Extension Unit, check the following:

- a. Check that both Extension Unit connecting plugs are firmly in their sockets.
- b. Check the setting of R1, inside the dust cover of the Range Extension Unit. Set the panel FREQUENCY IN CYCLES PER SECOND switch to 20, and rotate this adjustment clockwise until oscillation starts, very slowly, at 2 cps.
- c. If no oscillation can be obtained at any setting

of R1, check the values of C1, C2, and C3 in the Range Extension Unit.

NOTE

These are special polystyrene capacitors. Wax or oil-filled replacements are not satisfactory.

3.3 FREQUENCY ADJUSTMENT. It is unlikely that the oscillator frequency will ever require readjustment under normal use. However, three factory-set adjustments are provided to allow slight readjustment which might be occasioned by aging of components. The procedure for adjusting frequency is as follows:

- a. Set the panel switches for 4000 cps and 600 ohms.
- b. Adjust C102, C103, and C107 to the exact frequency (4000 cps). Keep the adjustments of C102 and C103 equal.
- c. Set the OUTPUT IMPEDANCE to 5000 ohms, use a 5000-ohm load, and measure the output voltage at 4000 cps.
- d. Set the oscillator frequency to 15,000 cps and adjust C107 to give the same output voltage as that measured in step c.
- e. Repeat all steps until frequency and output are correct.

TYPE 1301-A LOW-DISTORTION OSCILLATOR

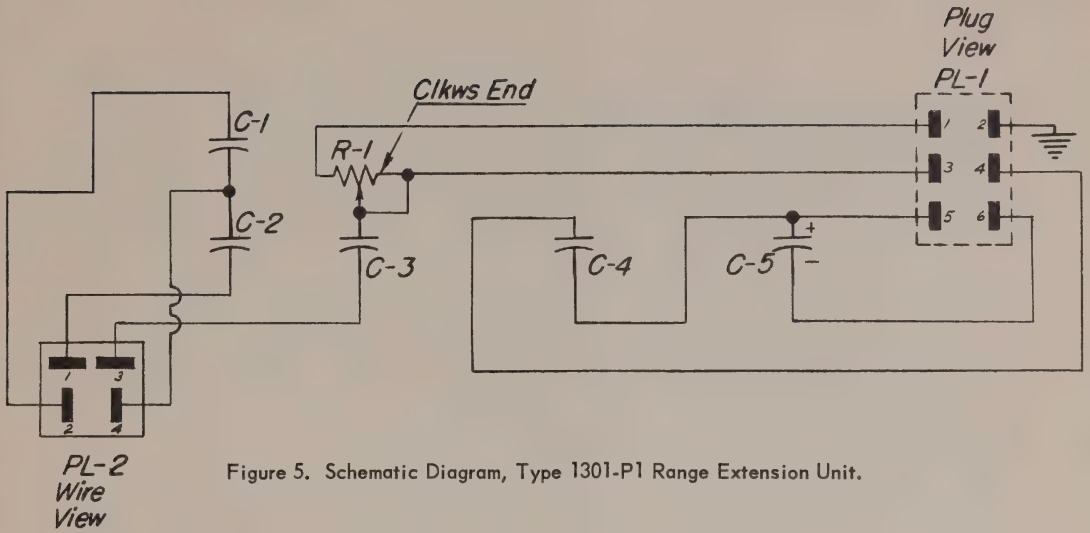


Figure 5. Schematic Diagram, Type 1301-P1 Range Extension Unit.

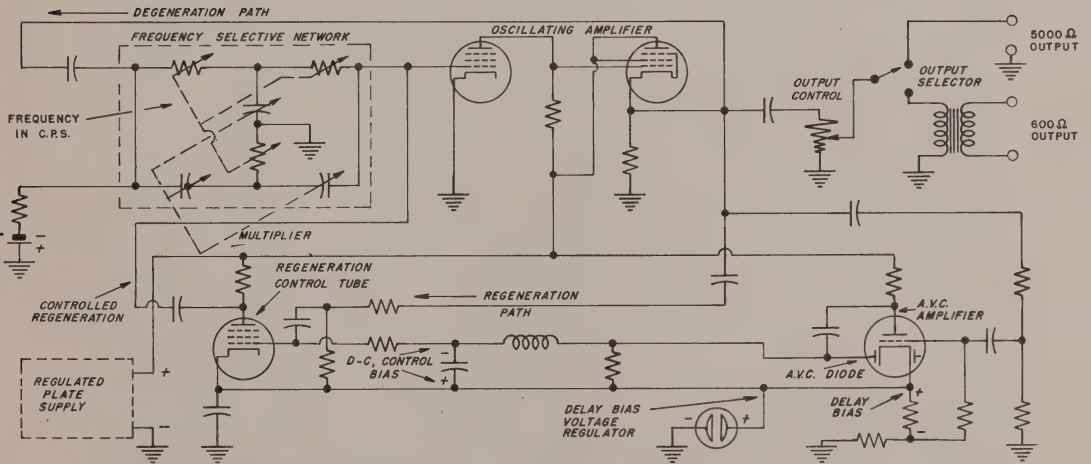


Figure 6. Elementary Schematic Diagram, Type 1301-A Low-Distortion Oscillator.

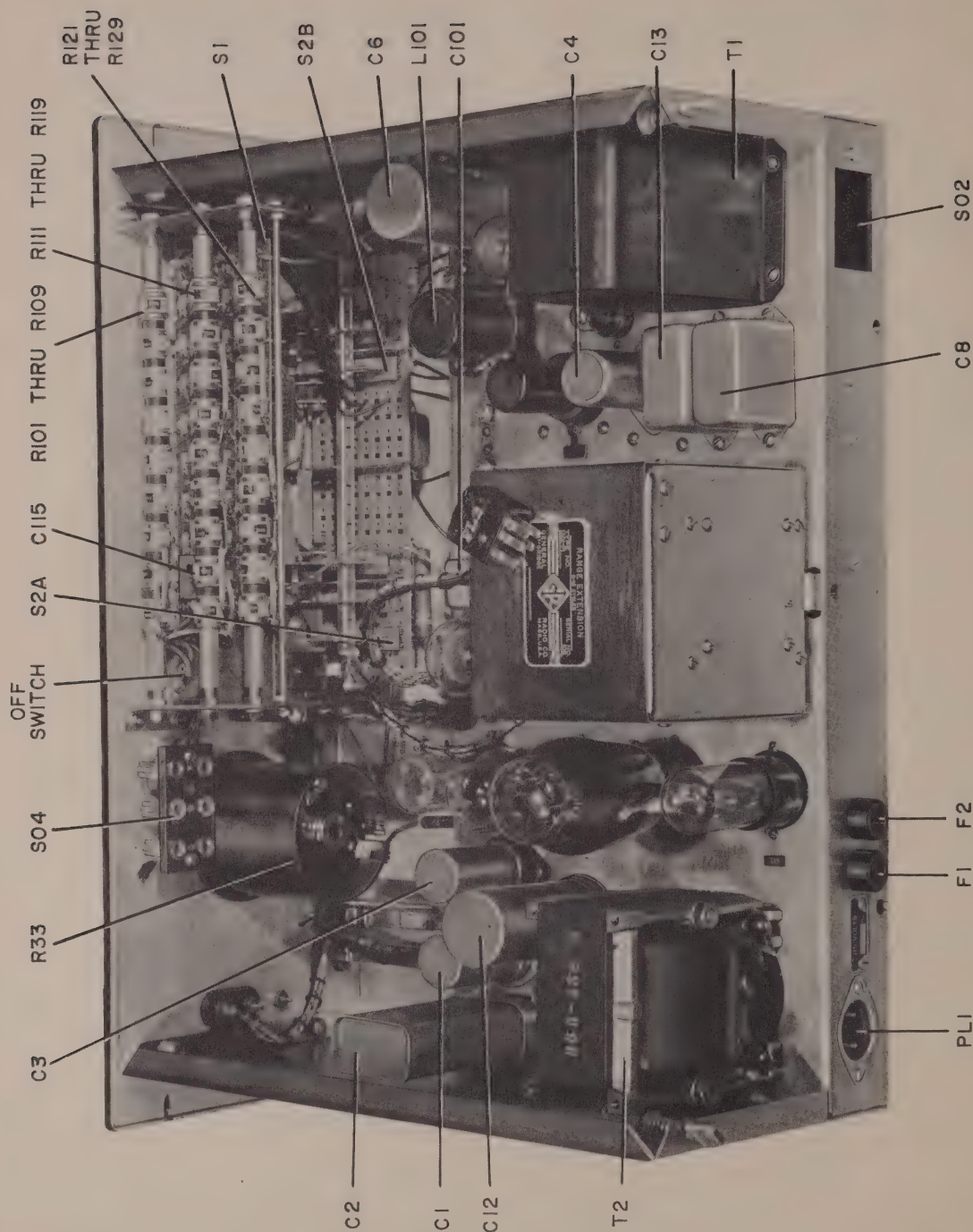


Figure 7. Interior View, Showing Type 1301-P1 Range Extension Unit in Position.

TYPE 1301-A LOW-DISTORTION OSCILLATOR

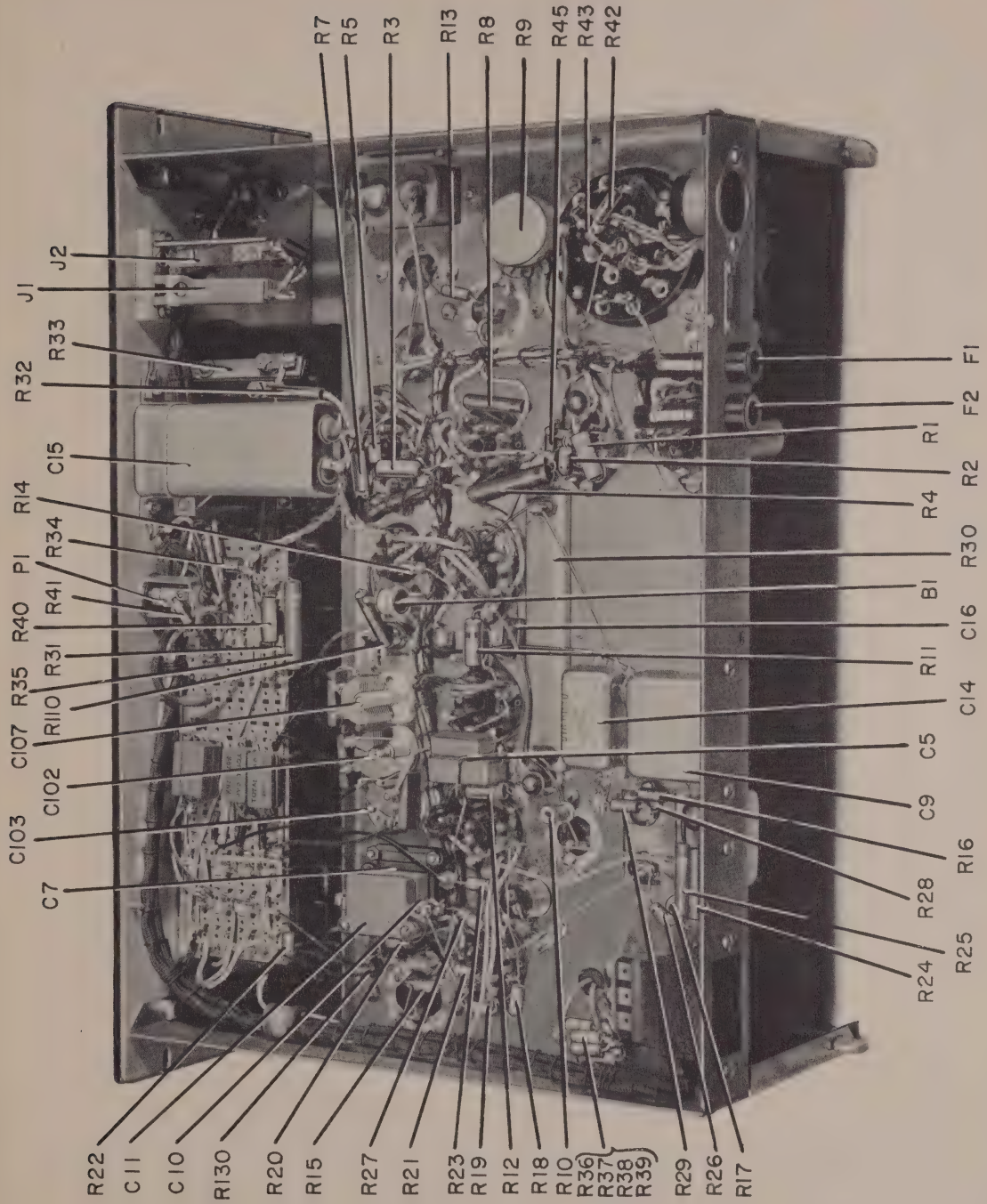


Figure 8. Bottom Interior View.

Section 4

PARTS LIST

				GR NO. (NOTE A)				GR NO. (NOTE A)					GR NO. (NOTE A)		
RESISTORS (NOTE B)	R1	0.47	M $\pm 10\%$ 1 w	REC-30BF	RESISTORS (NOTE B)	R112	40	k $\pm 0.1\%$	1301-40-9	CAPACITORS (NOTE C)	C113	0.07212 (NOTE F)		Part of 1301-42	
	R2	10	k $\pm 10\%$ 1/2w	REC-20BF		R113	16,667	k $\pm 0.1\%$	1301-40-4		C114	0.0006 $\pm 10\%$		COM-30B	
	R3	0.47	M $\pm 10\%$ 1 w	REC-30BF		R114	10	k $\pm 0.1\%$	1301-40		C115	(NOTE G)		COM-20B	
	R4	18	k $\pm 10\%$ 2 w	REC-41BF		R115	20	k $\pm 0.1\%$	1301-40-6		C116	(NOTE G)		COM-20B	
	R5	10	k $\pm 10\%$ 1/2w	REC-20BF		R116	13,333	k $\pm 0.1\%$	1301-40-3		C117	27 μ f	$\pm 10\%$	COM-20B	
	R6	10	k $\pm 10\%$ 1/2w	REC-20BF		R117	13.0	k $\pm 0.1\%$	1301-40-2		C118	20 μ f	$\pm 10\%$	COM-20B	
	R7	0.68	M $\pm 10\%$ 1 w	REC-30BF		R118	19.6	k $\pm 0.1\%$	1301-40-5		C119	7-45 μ f		COT-12	
	R8	2.0	k $\pm 5\%$ 1 w	REW-4C		R119	13.0	k $\pm 0.1\%$	1301-40-2						
	R9	1	k	POSW-3		R121	40	k $\pm 0.1\%$	1301-40-9						
	R10	1	M $\pm 1\%$ 1/2w	REF-1		R122	80	k $\pm 0.1\%$	1301-40-10						
	R11	0.2	M $\pm 1\%$ 1/2w	REF-1		R123	33,333	k $\pm 0.1\%$	1301-40-8						
	R12	0.39	M $\pm 10\%$ 1 w	REC-30BF		R124	20	k $\pm 0.1\%$	1301-40-6						
	R13	0.39	M $\pm 10\%$ 1/2w	REC-20BF		R125	40	k $\pm 0.1\%$	1301-40-9						
	R14	0.1	M $\pm 10\%$ 1/2w	REC-20BF		R126	26,667	k $\pm 0.1\%$	1301-40-7						
	R15	0.56	M $\pm 10\%$ 1/2w	REC-20BF		R127	26,667	k $\pm 0.1\%$	1301-40-7						
	R16	47	k $\pm 5\%$ 1/2w	REC-20BF		R128	40	k $\pm 0.1\%$	1301-40-9						
	R17	100	$\pm 1\%$	REPR-16K		R129	26,667	k $\pm 0.1\%$	1301-40-7						
	R18	0.39	M $\pm 5\%$ 1/2w	REC-20BF		R130	0.1	M $\pm 10\%$ 1/2w	REC-20BF						
	R19	0.82	M $\pm 5\%$ 1/2w	REC-20BF		R131	270	k $\pm 10\%$ 1/2w	REC-20BF						
	R20	0.1	M $\pm 10\%$ 1/2w	REC-20BF		R132	820	$\pm 10\%$ 1/2w	REC-20BF						
	R21	1.0	M $\pm 10\%$ 1/2w	REC-20BF		R133	100	$\pm 10\%$ 1/2w	REC-20BF						
	R22	10.0	M $\pm 10\%$ 1/2w	REC-20BF											
	R23	1.0	M $\pm 10\%$ 1/2w	REC-20BF											
	R24	1.0	M $\pm 5\%$ 1 w	REC-30BF		CAPACITORS (NOTE C)	C1	20	450dcwv	COE-5	MISCELLANEOUS	L1	INDUCTOR, 0.5h		119B
	R25	0.51	M $\pm 5\%$ 1 w	REC-30BF			C2	5	$\pm 10\%$	COL-9		P1	LAMP, 6.3v, Mazda 44	2LAP-939	
	R26	1.0	M $\pm 10\%$ 1/2w	REC-20BF			C3	20	450dcwv	COE-200		S1	SWITCH	SWPM-1	
	R27	560	k $\pm 10\%$ 1/2w	REC-20BF			C4	20	450dcwv	COE-200		S2a	SWITCH	SWPM-2	
	R28	56	k $\pm 5\%$ 1/2w	REC-20BF			C5	0.06	$\pm 10\%$ -5%	COM-50B		S2b	SWITCH	485-444-2	
	R29	47	k $\pm 5\%$ 1/2w	REC-20BF			C6	80	450dcwv	COE-201		T1	TRANSFORMER	365-438-3	
	R30	6	k $\pm 5\%$	REPO-8			C7	0.02	$\pm 10\%$	COM-50B		T2	TRANSFORMER		
	R31	18	k $\pm 10\%$ 1/2w	REC-20BF			C8	1.0	$\pm 10\%$	COL-45					
	R32	100	$\pm 10\%$ 1 w	REW-4C			C9	2.0	$\pm 10\%$	COL-66					
	R33	10	k $\pm 10\%$	471-404			C10	0.05	$\pm 10\%$	COM-50B					
R34	1	k $\pm 10\%$ 1 w	REC-30BF	C11	0.05		$\pm 10\%$	COM-50B							
R35	22	k $\pm 10\%$ 2 w	REC-41BF	C12	200		200dcwv	COE-24							
R36	330	$\pm 10\%$ 1/2w	REC-20BF	C13	1.0		$\pm 10\%$	COL-45							
R37	910	$\pm 5\%$ 1/2w	REC-20BF	C14	0.1		$\pm 10\%$	COL-11							
R38	910	$\pm 5\%$ 1/2w	REC-20BF	C15	4.0		$\pm 10\%$	COL-8							
R39	330	$\pm 10\%$ 1/2w	REC-20BF	C16	0.00015		$\pm 10\%$	COM-20B							
R40	27	k $\pm 10\%$ 1 w	REC-30BF	C17	25 μ f		$\pm 10\%$	COM-20B							
R41	15	$\pm 10\%$ 1 w	REW-3C												
R42	56	$\pm 10\%$ 1 w	REW-3C												
R43	56	$\pm 10\%$ 1 w	REW-3C												
R44	56	$\pm 10\%$ 1 w	REW-3C												
R45	56	$\pm 10\%$ 1 w	REW-3C												
R101	40	k $\pm 0.1\%$	1301-40-9												
R102	80	k $\pm 0.1\%$	1301-40-10												
R103	33,333	k $\pm 0.1\%$	1301-40-8												
R104	20	k $\pm 0.1\%$	1301-40-6												
R105	40	k $\pm 0.1\%$	1301-40-9												
R106	26,667	k $\pm 0.1\%$	1301-40-7												
R107	26,667	k $\pm 0.1\%$	1301-40-7												
R108	40	k $\pm 0.1\%$	1301-40-9												
R109	26,667	k $\pm 0.1\%$	1301-40-7												
R110	1	M $\pm 10\%$ 1/2w	REC-20BF												
R111	20	k $\pm 0.1\%$	1301-40-6												

NOTES:

(A) GR Part No. designations for resistors and capacitors are as follows:

COA - Capacitor, air
COE - Capacitor, electrolytic
COL - Capacitor, oil
COM - Capacitor, mica
COT - Capacitor, trimmer
POSW - Potentiometer, wire-wound
REC - Resistor, composition
REF - Resistor, film
REPO - Resistor, power
REPR - Resistor, precision
REW - Resistor, wire-wound

(B) All resistances are in ohms except as otherwise indicated by k (kilohms) or M (megohms).

(C) All capacitances are in microfarads, except as otherwise indicated by μf (micromicrofarads).(D) $C108 = C109 \pm 0.2\%$ $C110 = C108 + C109 \pm 0.2\%$ (E) $C111a + C111b$ (0.03630 μf) = $C112a + C112b$ (0.03630 μf) $\pm 0.2\%$ (F) $C113 = C111a, b + C112a, b + 480 \mu\text{f}$ $\pm 0.2\%$

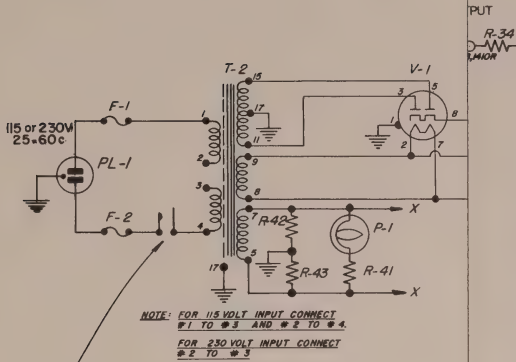
(G) Value determined in General Radio laboratory.

TYPE 1301-A LOW

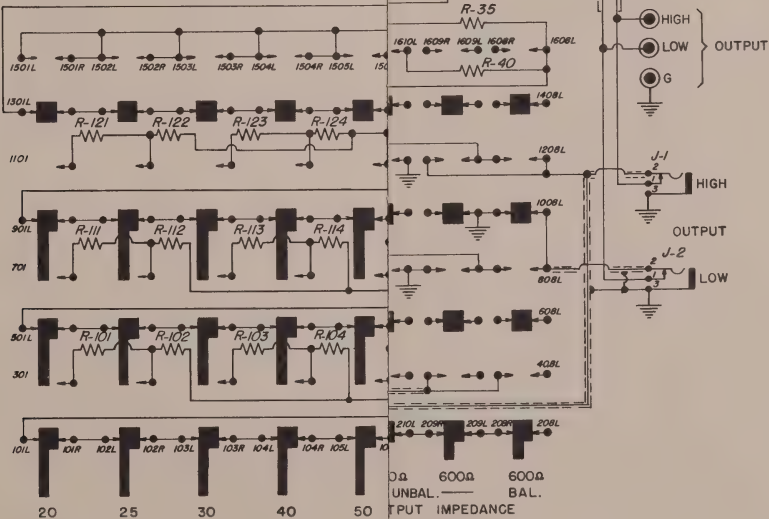
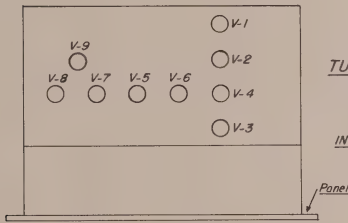


PL-2 SUPPLIED WITH INSTRUMENT.

NOTE: THIS PLUG PL-2 MUST BE IN POSITION ON SOCKET SO-1 WHEN RANGE EXTENSION 1301-P1 IS NOT IN USE.



THIS SWITCH ATTACHED TO "OFF" PLUNGER OF S-1.
SWITCH IS OPEN ONLY WHEN PLUNGER IS PUSHED WAY IN.



S-1

filed Schematic Diagram.

Section 4

PARTS LIST

					GR NO. (NOTE A)						GR NO. (NOTE A)			
RESISTORS (NOTE B)	R1	0.47	M ±10%	1 w	REC-30BF	R112	40	k ±0.1%	1301-40-9	CAPACITORS (NOTE C)	C113	0.07212 (NOTE F)		Part of 1301-42
	R2	10	k ±10%	1/2w	REC-20BF	R113	16.667	k ±0.1%	1301-40-4		C114	0.0006 ±10%		COM-30B
	R3	0.47	M ±10%	1 w	REC-30BF	R114	10	k ±0.1%	1301-40		C115	(NOTE G)		COM-20B
	R4	18	k ±10%	2 w	REC-41BF	R115	20	k ±0.1%	1301-40-6		C116	(NOTE G)		COM-20B
	R5	10	k ±10%	1/2w	REC-20BF	R116	13.333	k ±0.1%	1301-40-3		C117	27μf ±10%		COM-20B
	R6	10	k ±10%	1/2w	REC-20BF	R117	13.0	k ±0.1%	1301-40-2		C118	20μf ±10%		COM-20B
	R7	0.68	M ±10%	1 w	REC-30BF	R118	19.6	k ±0.1%	1301-40-5		C119	7-45μf		COT-12
	R8	2.0	k ± 5%	1 w	REW-4C	R119	13.0	k ±0.1%	1301-40-2					
	R9	1	k		POSW-3	R121	40	k ±0.1%	1301-40-9					
	R10	1	M ± 1%	1/2w	REF-1	R122	80	k ±0.1%	1301-40-10					
	R11	0.2	M ± 1%	1/2w	REF-1	R123	33.333	k ±0.1%	1301-40-8					
	R12	0.39	M ±10%	1 w	REC-30BF	R124	20	k ±0.1%	1301-40-6					
	R13	0.39	M ±10%	1/2w	REC-20BF	R125	40	k ±0.1%	1301-40-9					
	R14	0.1	M ±10%	1/2w	REC-20BF	R126	26.667	k ±0.1%	1301-40-7					
	R15	0.56	M ±10%	1/2w	REC-20BF	R127	26.667	k ±0.1%	1301-40-7					
	R16	47	k ± 5%	1/2w	REC-20BF	R128	40	k ±0.1%	1301-40-9					
	R17	100	± 1%		REPR-16K	R129	26.667	k ±0.1%	1301-40-7					
	R18	0.39	M ± 5%	1/2w	REC-20BF	R130	0.1	M ±10%	1/2w	REC-20BF				
	R19	0.82	M ± 5%	1/2w	REC-20BF	R131	270	k ±10%	1/2w	REC-20BF				
	R20	0.1	M ±10%	1/2w	REC-20BF	R132	820	±10%	1/2w	REC-20BF				
	R21	1.0	M ±10%	1/2w	REC-20BF	R133	100	±10%	1/2w	REC-20BF				
	R22	10.0	M ±10%	1/2w	REC-20BF									
	R23	1.0	M ±10%	1/2w	REC-20BF									
	R24	1.0	M ± 5%	1 w	REC-30BF	C1	20	450dcwv	COE-5					
	R25	0.51	M ± 5%	1 w	REC-30BF	C2	5	±10%	COL-9					
R26	1.0	M ±10%	1/2w	REC-30BF	C3	20	450dcwv	COE-200						
R27	560	k ±10%	1/2w	REC-20BF	C4	20	450dcwv	COE-200						
R28	56	k ± 5%	1/2w	REC-20BF	C5	0.06	±10%-5%	COM-50B						
R29	47	k ± 5%	1/2w	REC-20BF	C6	80	450dcwv	COE-201						
R30	6	k ± 5%		REPO-8	C7	0.02	±10%	COM-50B						
R31	18	k ±10%	1/2w	REC-20BF	C8	1.0	±10%	COL-45						
R32	100	±10%	1 w	REW-4C	C9	2.0	±10%	COL-66						
R33	10	k ±10%		471-404	C10	0.05	±10%	COM-50B						
R34	1	k ±10%	1 w	REC-30BF	C11	0.05	±10%	COM-50B						
R35	22	k ±10%	2 w	REC-41BF	C12	200	200dcwv	COE-24						
R36	330	±10%	1/2w	REC-20BF	C13	1.0	±10%	COL-45						
R37	910	± 5%	1/2w	REC-20BF	C14	0.1	±10%	COL-11						
R38	910	± 5%	1/2w	REC-20BF	C15	4.0	±10%	COL-8						
R39	330	±10%	1/2w	REC-20BF	C16	0.00015	±10%	COM-20B						
R40	27	k ±10%	1 w	REC-30BF	C17	25μf	±10%	COM-20B						
R41	15	±10%	1 w	REW-3C	C101	0.125	±10%	COL-49						
R42	56	±10%	1 w	REW-3C	C102	50μf		COA-2L						
R43	56	±10%	1 w	REW-3C	C103	50μf		COA-2L						
R44	56	±10%	1 w	REW-3C	C104	340μf	± 5%	COM-20E						
R45	56	±10%	1 w	REW-3C	C105	340μf	± 5%	COM-20E						
R101	40	k ±0.1%		1301-40-9	C106	680μf	± 5%	COM-20E						
R102	80	k ±0.1%		1301-40-10	C107	100μf		COA-4						
R103	33.333	k ±0.1%		1301-40-8	C108	3575μf								
R104	20	k ±0.1%		1301-40-6	C109	3575μf	(NOTE D)	1301-41						
R105	40	k ±0.1%		1301-40-9	C110	7150μf								
R106	26.667	k ±0.1%		1301-40-7	C111a	0.03606		Part of 1301-42						
R107	26.667	k ±0.1%		1301-40-7				COM-20C						
R108	40	k ±0.1%		1301-40-9	C111b	240μf ±2%	(NOTE E)	Part of 1301-42						
R109	26.667	k ±0.1%		1301-40-7	C112a	0.03606		Part of 1301-42						
R110	1	M ±10%	1/2w	REC-20BF				COM-20C						
R111	20	k ±0.1%		1301-40-6	C112b	240μf ±2%		COM-20C						

NOTES:

(A) GR Part No. designations for resistors and capacitors are as follows:

(B) All resistances are in ohms except as otherwise indicated by k (kilohms) or M (megohms).

COA - Capacitor, air
COE - Capacitor, electrolytic
COL - Capacitor, oil
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REW - Resistor, wire-wound

(C) All capacitances are in microfarads, except as otherwise indicated by μmf (micromicrofarads).

(D) $C108 = C109$ to $\pm 0.2\%$ $C110 = C108 + C109$ to $\pm 0.2\%$

(E) C111a + C111b (0.03630 μf) = C112a + C112b (0.03630 μf) to $\pm 0.2\%$

(F) C113 = C111a, b + C112a, b + 480 μ f to $\pm 0.2\%$

(G) Value determined in General Radio laboratory.

TYPE 1301-A LOW-DISTORTION OSCILLATOR

